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Loan syndication and cocoa production: Evidence from Ghana

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Abstract

The syndication of loans is an innovative financing model that has emerged in the financial landscape to help lenders spread risk and share opportunities. This study examines the relationship between syndicated loans and cocoa production in Ghana, using annual time-series data spanning from 1993 to 2020, as well as the autoregressive distributed lag model (ARDL). The study found a positive and significant short-run and long-run relationship between syndicated loans and cocoa production. Specifically, a 1% increase in the amount of syndicated loans increases cocoa production by 0.25% in the long run. The Ghana Cocoa Board should ensure efficient utilisation of syndicated loans by investing in productivity-enhancing programmes to boost cocoa production.

Key words: syndicated loan, cocoa, Cobb-Douglas**,** ARDL, Ghana

1. Introduction

Cocoa production continues to play a critical role in the socio-economic development of Ghana through its contribution to revenue generation, the provision of employment, foreign exchange generation and poverty reduction (Anim-Kwapong & Frimpong 2004). Cocoa is one of the major foreign exchange earners for Ghana, with an average earning of $2.6 billion per annum, representing 20% of total national export revenue (Goodman AMC LLC 2017). Ghana's foreign exchange earnings from cocoa rank third, after gold and oil. The cocoa sector also provides employment for many rural people and stakeholders, such as licensed produce-buying firms, agrochemical firms, chocolate producers and cosmetics manufacturers within the cocoa value chain (Asamoah & Baah

2003). Not only is Ghana's cocoa production capacity second in the world, but it is also recognised as being of the highest quality in the world market (Gilbert 2009). The sector creates value addition of nearly 10% for the national total productive output (Boadu 2014). Danso-Abbeam *et al*. (2012) note that Ghana's cocoa industry is an essential economic sector, as it acts as a chief source of export and fiscal earning for the Ghanaian economy.

Agricultural credit has been found to have a significant positive effect on agricultural production in both developed and developing economies (Hussain & Thapa 2012; Rahman *et al*. 2014; Abdallah 2016; Islam 2020). Agricultural credit affords farmers the opportunity to increase the utilisation of farm inputs (Rahman *et al*. 2014; Akudugu 2016), which in turn has a positive effect on production. Seven and Tumen (2020) also found that doubling agricultural credits increases agricultural productivity by 4% to 5%. According to Anetor *et al*. (2016), credit to agriculture facilitates the acquisition of inputs and the adoption of modern technology to enhance productivity. At government level, African heads of state have also made a number of efforts to increase credit to the agricultural sector to boost agricultural and economic growth. Among these efforts is the 2003 Maputo Declaration, which requires African governments to allocate at least 10% of their national budgets to the agricultural sector. Agricultural credits have come from donor bodies, governments and individual banks/lenders that bear the entire risk. Mobilising credit from innovative sources that allows lenders to spread risk will be good to enable the sector to maximise its potential.

Over the years, Ghana's cocoa sector has benefited immensely from credits from various sources, including banks and donor agencies, including the African Development Bank, all of these with the aim of boosting production (O'Sullivan & Vanamali 2020). Notwithstanding this, the sector continues to face limited access to credit, which limits its ability to maximise its full potential (Mensah *et al*. 2020). In the 1993/1994 fiscal year, the government of Ghana, through the Ghana Cocoa Board (COCOBOD), initiated a move to source sustainable funding to boost cocoa production, which resulted in the introduction of loan syndication. A syndicated loan is offered by a group of lenders who work together to provide credit to a large borrower, who may be an individual project, corporation or government (Corporate Finance Institute 2021). Participant banks join loan syndications when their capital levels are sufficient enough to support the extra risk taken (Altunbas & Kara 2011). By using several banks to jointly provide a syndicated facility, credit risk is shared among the participating banks (Farid 2017). Also, syndicated loans reduce borrowers' dependence on one bank to raise a large loan. Syndicated loans are cheaper than bonds, hence preferred by many borrowers (Altunbas *et al*. 2005). By way of the syndication arrangement, COCOBOD issues letters inviting various banks to bid in respect of funds to purchase the ensuing year's cocoa. After receiving the responses, an evaluation is done and a mandate awarded to the best bid based on pricing and other qualitative factors. The mandated banks syndicate the deal amount and invite other banks to participate in raising the amount, thereby spreading their risk. Syndicated finance is acquired from the international money market as a receivables-backed syndicated loan each year to finance cocoa purchases.

Since its first arrangement, Ghana continues to receive a syndicated loan, with the highest of US$2 billion to support cocoa production recorded in 2012. This facility is used to purchase fertiliser, finance pest control and undertake productivity-enhancement programmes, such as the national cocoa rehabilitation programme, the hand pollination programme, a mass spraying exercise, distribution of free seedlings, the distribution of subsidised fertiliser and a roads-improvement initiative in the cocoa-producing regions. These interventions are meant to achieve a sustainable cocoa economy and to improve the livelihood of cocoa farmers. The available data from COCOBOD indicates that the growth in the amount of syndicated loans obtained by COCOBOD exceeds the growth in cocoa production by 3%. While the amount of syndicated loans grew by 8.8% on the average, cocoa production grew by 5.8% over the same period (see Figure 1). Ghana recorded a production of more

than one million metric tons of cocoa in the 2020/2021 season, which was beyond the target set. For this, syndicated loans to a value of $1.3 billion worth were acquired. Meanwhile, COCOABOD is considering to increase its syndicated loan target for the 2021/2022 crop season to US$1.5 billion. Given that the growth trend of the two variables shows an irregular pattern over the period, the question that arises is whether a larger syndicated loan is needed to increase cocoa production in the long run.

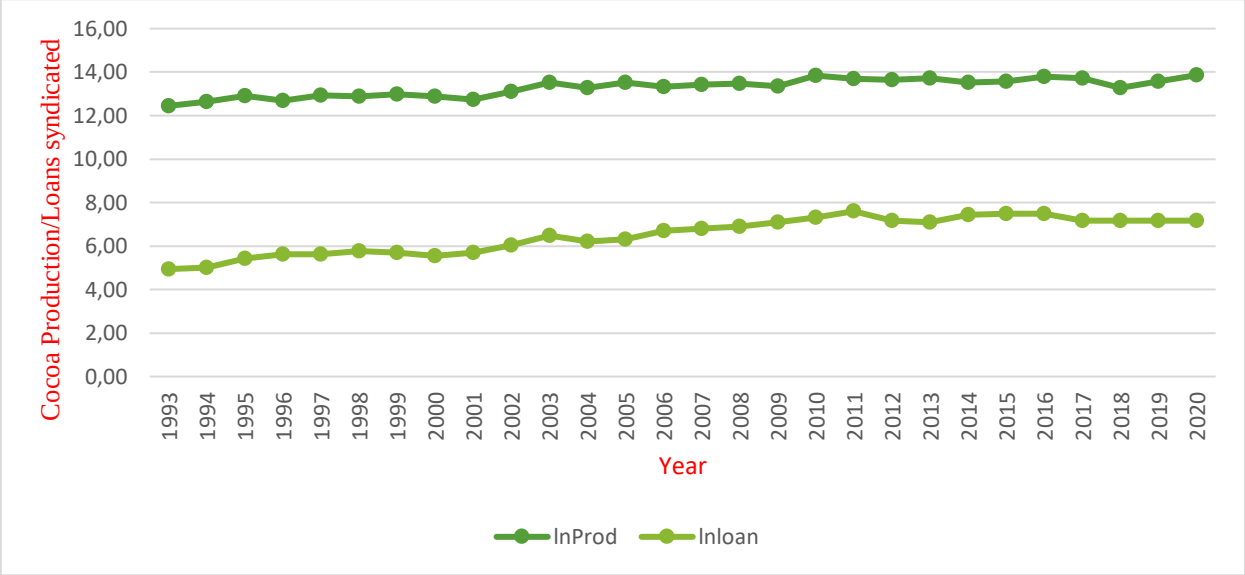

Figure 1: Cocoa production (lnprod) and loans syndicated (lnloan) by COCOBOD

Studies have examined the impact of agriculture credit on agricultural production in developing countries (Kadri *et al*. 2013; Afful *et al*. 2015). But most of these studies focused on credit from the public sector and banks, where the entire risk is borne by the lender, and not on international loan syndication, where the risk is shared among the lenders. Other studies, however, have focused on why banks participate in loan syndication (Altunbas *et al*. 2005). To the best of our knowledge, no studies have examined the relationship between syndicated loans and cocoa production in Ghana. This study therefore examined the relationship between syndicated loans and cocoa production in Ghana to ascertain the short-run and long-run relationship between the two variables. The study will enable policymakers to know the extent of the influence of syndicated loans on cocoa production for appropriate policy interventions to achieve the desired results.

The rest of the paper is structured as follows: Section 2 presents the methods and materials used for the study. This is followed by Section 3, which discusses the results of the study. The final section presents the policy implications of the findings, along with the conclusion and recommendations.

2. Materials and methods

The study used a quantitative design and annual time-series data covering the period 1993 to 2020. The period chosen indicates the time from the introduction of the syndicated loan for cocoa production in Ghana. The data was obtained from the annual reports of the Bank of Ghana, COCOBOD, FAOSTATS and World Bank/ICCO (see Table 1).

The theoretical framework that underpins the study is the Cobb-Douglas production function, which was first developed and applied to the manufacturing industry in 1927. The Cobb-Douglas production function, which is widely used in productivity studies, was developed to model the standard timing distinction amid moments that capital and variable factors are chosen without adding any assumption

to the existing method (Cobb & Douglas 1928). The function assumes constant returns to scale. The choice of the Cobb-Douglas production function for the study is based on its flexibility to handle multiple inputs in its generalised form, and its ability to be transformed into a linear form (Murthy 2002).

The general form of a Cobb-Douglas production function for a set of two inputs is specified as:

$$Y = AL^{\alpha}K^{\beta}, \quad (1)$$

where *Y* is the production level, *A* is technology, *L* is labour input and *K* is capital inputs. α and β are the output elasticity of labour and capital respectively. Based on this, and using the time-dependent variable, $Prod_t$ is the dependent variable used for the study: the amount of cocoa output and *t* represent the annual time of cocoa production. Assuming that the current representativeness of the production level in Ghana is a result of loan syndication, (($lnFund_t$) – which is mainly solicited capital funding – and using cocoa inputs, world price of cocoa (lnavPr) and hectare of area harvested ($lnareaH_t$) are the independent variables. The annual change in cocoa production considers the simplicity of an augmented Cobb-Douglass production function, which, in its natural logarithmic form (ln), transforms the basic theoretical framework as follows:

$$\ln Prod_t = \theta_1 \ln Fund_t + \theta_2 \ln avPr + \theta_3 \ln areaH_t + \epsilon_t, \quad (2)$$

where θ_1, θ_2 *and* θ_3 are the elasticities or coefficients of the log-linear specification of the loan syndication (lnfund) variable, average world price of cocoa (lnavPr) and hectare of area harvested (lnreaH) respectively, and ϵ is the error term of the unexplained factors. The model representation assumes that loan syndication, price of cocoa and hectares of area harvested are the inputs used in the production function. Logarithmic transformation of the variables was performed to eliminate heteroscedasticity and instabilities (Deng 2021).

Table 1: Description and measurement of variables used in the study

Variable	Description	Measurement	Source
lnProd	Annual cocoa production in tons	Natural log of cocoa production	COCOBOD
lnavPr	Average world cocoa price* in US dollars	Natural log of average of world cocoa price	World Bank/ICCO
lnareaH	Area harvested	Natural log of area harvested	FAOSTAT
lnfund	Syndicated loan amount	Natural log of loan syndication amount	COCOBOD

Note: * Global cocoa price obtained from https://fred.stlouisfed.org/series/PCOCOUSDM
Source: Authors' calculation

3.1 Model specification: Autoregressive distributed lag (ARDL) model

The ARDL model was estimated to determine the short-run and long-run relationship between the syndicated loan and cocoa output. Unlike other time-series models (Engle & Granger 1987) and the maximum likelihood-based approaches (Johansen & Juselius 1990; Johansen 1992), Pesaran and Shin (1995) show that the ARDL model can estimate cointegration relationship among variables. Following the empirical study of Coulibaly and Erbao (2019) and that of Chaudhary (2017), the ARDL model specified as in equation (3) was used for this study:

$$\Delta \ln Prod_t = \beta_o + \beta_1 \ln Prod_{t-1} + \beta_2 \ln fund_{t-1} + \beta_3 \ln avPr_{t-1} + \beta_4 \ln areaH_{t-1} + \sum_{i=0}^{p} \alpha_{1i} \Delta \ln Prod_{t-i} + \sum_{i=0}^{p} \alpha_{2i} \Delta \ln fund_{t-i} + \sum_{i=0}^{p} \alpha_{3i} \Delta \ln avPr_{t-i} + \sum_{i=0}^{p} \alpha_{4i} \Delta \ln areaH_{t-i} + \varepsilon_t, \quad (3)$$

where β_o is the intercept, p is the lag order, Δ is the first difference operator, and ε_t is the error term assumed to be uncorrelated and homoscedastic. The dependent variable is $Prod_t$, with auto-distributed lag-dependent variable $Prod_{t-i}$. The formulation has β_1 *to* β_4 as long-run parameters, while α_1 *to* α_4 are the short-run parameters of cocoa production, funding (syndicated loan), the average world price of cocoa and area harvested.

Before estimating the ARDL model, a pre-estimation test of stationarity and the appropriateness of the dataset was conducted (Gujarati *et al*. 2012). The study employed both the Phillips–Perron (PP) and augmented Dickey–Fuller (ADF) (Dickey & Fuller 1987) tests of stationarity. This testing is vital in solving the problem of spurious regression with non-stationary variables. It ensures that the variables are stationary at level or requires differencing to attain either a first- or second-level stationary process for estimation (Gujarati *et al*. 2012). The study conducted cointegration tests to test if there was at least stationarity of order I(0) from one linear combination of any two or more groups of variables – which, if they are individually integrated of the same order, say I(1) stationary, then these combined sets of the variables are said to be co-integrated. Thus, there is a co-movement within some sets of variables series such that they are attracted in the long-run equilibrium relation. This study conducted the bounds test for co-integration or long-run equilibrium (Pesaran *et al*. 2001). The condition for the conduct of the bounds test to be feasible is only if the series are a $I(0)$ or $I(1)$ stationary process. Also, it is a diagnostic test to check whether there is a common inaccurate dynamic approach. The F test was calculated under two sets of critical values, with $I(0)$: lower bound and $I(1)$: upper bound for a selected significance level under H_0, viz. that no cointegration exists between the variables, against an H_a that cointegration exists, with at least one of $\beta_j \neq 0$, as follows:

$$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$$

$$H_a: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$$

If the absolute calculated F statistics is above the upper bound critical value, then we reject H_0 of no co-integration, otherwise we accept or fail to reject H_0 if the F statistic lies below the critical value of the lower bound. If the bounds test shows evidence of co-integration or a long-run relationship among variables of the regression model, then we run the ARDL to examine the long-run regression model with the error-correction term (ECT) included. In the presence of a long-run relationship, the preferred model is specified as:

$$\Delta \ln Prod_t = \beta_o + \sum_{i=0}^{p} \alpha_{1i} \Delta \ln Prod_{t-i} + \sum_{i=0}^{p} \alpha_{2i} \Delta \ln fund_{t-i} + \sum_{i=0}^{p} \alpha_{3i} \Delta \ln avPr_{t-i} + \sum_{i=0}^{p} \alpha_{4i} \Delta \ln areaH_{t-i} + \lambda ECT_{t-1} + \varepsilon_t, \quad (4)$$

where λECT_{t-1} is the long-run relationship, ECT_{t-1} is the error-correction term, which is the residual obtained from the estimated co-integration model, and ε is white noise. λ is the speed of adjustment to long-run convergence (equilibrium). When it is determined that there is no cointegration, then (3) has to be estimated without the λECT_{t-1} term. That is, only the short-run relationship would be estimated.

3. Results and discussion

The descriptive statistics of the variables used in the study are presented in Table 2. This shows an average cocoa production of 639 055 tons over the period of the study, with maximum and minimum quantities of 1 045 500 tons and 254 653 tons respectively. This average is below the target value of

one million tons that the government projected could be achieved. At the same time, the average syndicated loan amount over the period was $884.82 million, with maximum and minimum values of $2 billion and $140 million respectively. Again, the average world cocoa price and area harvested under cocoa production were $2 018 392 and 1 490 395 hectares respectively.

Table 2: Descriptive statistics of variables

	Cocoa output (tons)	Syndicated loan ($m)	Average world price ($)*	Area harvested (hectares)
Mean	639 055.60	884.82	2 018.39	1 490 395.00
Median	656 414.50	855.00	1 866.72	1 600 250.00
Maximum	1 045 500.00	2 000.00	3 135.17	2 000 000.00
Minimum	254 653.00	140.00	903.91	686 531.00
Std. Dev.	233 587.60	584.99	687.25	338 285.80
Skewness	0.030	0.29	0.22	-0.94
Kurtosis	1.84	1.75	1.82	3.15
Jarque-Bera	1.55	2.21	1.83	4.17
Probability	0.46	0.33	0.40	0.12

Note: * Global cocoa price obtained from https://fred.stlouisfed.org/series/PCOCOUSDM
Source: Authors' calculations

Table 3 shows the results of the augmented Dickey–Fuller (1979) test and the Phillips–Perron test (Phillips & Perron 1988) used to test for stationarity. It shows that the variables are integrated of mixed order, I(0) and I(1), providing a sufficient justification for the use of the ARDL model as the most preferred estimator in this study. *lnProd* is stationary at level, I(0) while *lnavPr*, *lnareaH* and *lnfund* are all stationary at first difference, I(1).

Table 3: Results of unit root test of variables

	ADF test		PP test		
Variables	**Level**	**First difference**	**Level**	**First difference**	**Remark**
lnProd	-3.62**	-5.75*	-3.62**	-16.44*	I(0)
lnavPr	-3.23	-3.98**	-2.37	-3.75**	I(1)
lnareaH	-2.73	-6.71*	-2.70	-7.10*	I(1)
lnfund	-1.38	-5.29*	-1.21	-7.12*	I(1)

Source: Authors' calculations. * and ** indicate levels of significance at 1% and 5% respectively.

To ascertain the possibility of the series/variables exhibiting a long-run relationship, the bounds test was conducted and the results show an F-statistic (F = 8.37) (see Table 4) greater than the upper bound, suggesting the existence of a long-run relationship. This also implies that the null hypothesis of no co-integration is strongly rejected in favour of the alternative hypothesis, which indicates a long-run relationship (co-integration) among the variables.

Table 4: Co-integration test using the bounds test

Test statistic	Value	K	Level of significance	Critical value bounds	
F-statistic	**8.37**	**3**		**Lower bound**	**Upper bound**
			10%	2.01	3.10
			5%	2.45	3.63
			2.5%	2.87	4.16
			1%	3.42	4.84

Source: Authors' estimations with data from COCOBOD and ICCO.

Table 5 presents the error-correction representation of the ARDL model, showing the possibility of any disequilibrium in the short run being immediately adjusted to the long-run equilibrium. This property is indicated by the error-correction term (ECT) in Table 5, which appears as CoinEq(-1)*. The coefficient (0.95) is negative, as expected, and statistically significant at 1%. This implies that

the speed of adjustment towards the long-run equilibrium by the included variables is about 95%. In other words, any error in the past is corrected at a speed of 95% in the current year. The result also shows that the current syndicated loan does not have any significant effect on current cocoa production, but rather with a lag. This means that a 1% increase in the previous year's funding is positively and significantly associated with an increase in cocoa production of about 0.39% in the short run. What becomes clear is the importance of the syndication of the loan facility to boost cocoa production in Ghana. The result also points to the fact that world cocoa prices in the previous period positively and significantly influence cocoa production in Ghana in the short run. However, the area harvested in hectares does not show any positive and significant relationship with cocoa production in the short run. The overall fit of the model, as indicated by the adjusted R-square, is 72%, and this shows a high degree of fitness of the model estimated.

Table 5: Error correction representation of the Model (ECM)

Variables	Coefficient	Standard error	t-statistic
D(lnfund)	0.138	0.194	0.713
D(lnfund (-1))	0.386	0.155	2.489
D(lnareaH)	-0.084	0.260	-0.322
D(lnareaH (-1))	-0.288	0.202	-1.427
D(lnareaH (-2))	0.493	0.224	2.199
D(lnavPr)	-0.269	0.200	-1.345
D(lnavPr (-1))	0.782	0.226	3.465
D(lnavPr (-2))	0.508	0.194	2.622
CointEq(-1)*	-0.950	0.232	-4.085
R-squared	0.814	Sum squared residual	0.046
Adjusted R-squared	0.720	Log likelihood	43.308
Standard error of regression	0.054	Durbin-Watson statistic	1.873

Source: Authors' estimation

Given that the ARDL model shows co-integration, this study proceeded to examine the long-run relationship among the variables. The results are captured in Table 6. As expected, the amount of syndicated loan represented by the funding variable and the area covered in hectares have a positive and significant relationship with cocoa production in the long run. The result shows that, in the long run, a 1% increase in the amount of loan syndicated and utilised for cocoa production will increase cocoa production output by 0.25%. This finding suggests the need to ensure efficient use of the syndicated loan to boost cocoa production in the country in the long run.

The study further found that a 1% increase in area harvested for cocoa production boosts cocoa production by 0.45% in the long run. The positive relationship between area harvested and cocoa production found in this study is consistent with evidence found in existing studies (Fadipe *et al*. 2012; Darkwah & Verter 2014; Vigneri & Kolavalli 2017). The study thus establishes that area harvested exerts a positive influence on cocoa production in the short run but not in the long run. This could imply that farmers may have to continuously enrich the areas covered to sustain the capacity of the land to produce more cocoa in both the short and the long run. Again, the findings show that farmers may react quickly to boost cocoa production in the short run as world cocoa prices increase, but when that fails to materialise in the long run, they might not be encouraged to increase cocoa production in the long run if there should be an increase in the world cocoa price.

Table 6: Long-run ARDL estimation coefficients

Variables	Coefficient	Standard error	t-statistic
lnProd(-1) *	-1.31	0.25	-5.27
Lnfund **	0.33	0.16	2.08
lnareaH **	0.59	0.13	4.44
lnareaH (-1)	0.31	0.24	1.26
D(lnavPr)	-0.04	0.23	-0.17
Long-run form coefficients			
Variables	**Coefficient**	**Standard error**	**t-statistic**
Lnfund	0.25	0.10	2.57
lnareaH	0.45	0.07	6.94
lnavPr	0.23	0.2.0	1.20

Source: Authors' estimation

A test of the ARDL estimation shows that it is very robust to serial correlation and heteroscedasticity, and stable using CUSUM and CUSUM squared. Thus, the result of the ARDL framework does not suffer from serial correlation and heteroscedasticity. The Breusch-Godfrey serial correlation LM test (χ^2 = 0.66; p-value = 0.83) for serial correlation is greater than the 5% level of significance and that of the heteroskedasticity test. The Breusch-Pagan-Godfrey (χ^2 = 0.44; p-value = 0.55) is also greater than the 5% level of significance. Furthermore, the CUSUM and CUSUM squared indicate that the stability of the estimated ARDL model falls with the acceptable 5% level of significance (see Figure 2).

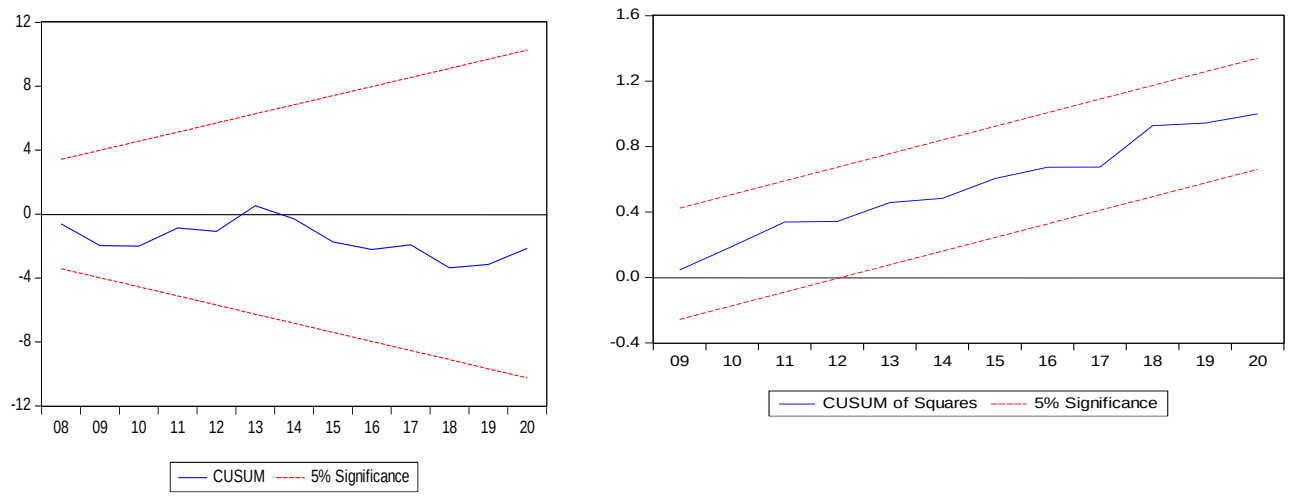

Figure 2: Stability tests
Source: Authors' computation

Besides the ARDL estimation, the study further implemented Granger causality analysis between the variables as a robustness test. The results are captured in Table 7. Consistent with the observations made earlier, the results show that funding from loan syndication Granger causes cocoa production at the 1% level of significance, while area harvested Granger causes cocoa production at the 10% level of significance. Again, cocoa production Granger causes area harvested at the 5% level of significance, while world cocoa price Granger causes cocoa production at the 1% level of significance and cocoa production Granger causes the world cocoa price at the 5% level of significance.

Table 7: Granger causality analysis

Null hypothesis	F-statistic	Probability
lnfund does not Granger cause lnProd	7.16	0.00
lnProd does not Granger cause lnfund	0.31	0.74
lnareaH does not Granger cause lnProd	2.99	0.07
lnProd does not Granger cause lnareaH	5.56	0.01
lnavPr does not Granger cause lnProd	6.27	0.00
lnProd does not Granger cause lnavPr	4.27	0.03
lnareaH does not Granger cause lnfund	1.49	0.25
lnfund does not Granger cause lnareaH	0.89	0.43
lnavPr does not Granger cause lnfund	7.47	0.00
lnfund does not Granger cause lnavPr	5.54	0.01
lnavPr does not Granger cause lnareaH	0.91	0.42
lnareaH does not Granger cause lnavPr	2.62	0.09

Source: Authors' estimation

The Granger causality further suggests a unidirectional causality running from funding to cocoa production, but bi-directional causality running from area harvested to cocoa production and cocoa production to area harvested. Similarly, the Granger causality demonstrates a bi-directional causality from world cocoa price to cocoa production and cocoa production to world cocoa price. Efforts to arrange for more syndicated loans will enable the Ghana Cocoa Board to implement its productivity-enhancing interventions to increase cocoa production in the country.

4. Conclusion and recommendations

The syndication of loans is an innovative financing model that has emerged in the financial landscape to help lenders spread risks and share financial opportunities. Through the government of Ghana, the Ghana Cocoa Board first arranged for a syndicated loan in 1993 to finance the purchase of cocoa from licensed produce-buying companies and to implement interventions to boost production to at least one million metric tons. This study examined the relationship between the amount of loan syndicated and cocoa production in Ghana using the ARDL model. The choice of the ARDL was based on its ability to measure long-run relationships. The bounds testing employed in the study indicates that there is a long-run relationship among the variables. Furthermore, the results of the ARDL estimation show that loan syndication is a significant determinant of cocoa production, both in the short run and the long run. A unit increase in the amount of loan syndicated significantly increases cocoa production in the long run.

An important policy implication of the findings is that cocoa production responds positively to the amount of loan syndication received by COCOBOD. Thus, continuous effort must be made by COCOBOD and governments to seek more syndicated loans to finance cocoa production in the country. Also, COCOBOD should use syndicated loans obtained more efficiently to implement productivity-enhancing interventions to effectively increase cocoa production beyond the one million metric ton target of the Ghanaian government. Finally, COCOBOD should design and implement effective systems to monitor the use of syndicated loans in order to maximise their benefits.

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